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RISK FACTORS FOR FOUR-YEAR INCIDENT VISUAL IMPAIRMENT AND BLINDNESS: THE LOS ANGELES LATINO EYE STUDY

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Abstract

Purpose—To identify independent risk factors for incident visual impairment (VI) and monocular blindness.

Design—Population-based prospective cohort study.

Participants—4,658 Latinos aged 40 years in the Los Angeles Latino Eye Study (LALES)

Methods—A detailed history and comprehensive ophthalmological examination was performed at baseline and at the 4-year follow-up on 4,658 Latinos aged 40 years and older from Los Angeles, California. Incident VI was defined as best corrected visual acuity (BCVA) of <20/40 and >20/200 in the better-seeing eye at the 4 year follow-up examination in persons who had a BCVA of 20/40 in the better seeing eye at baseline. Incident monocular blindness was defined as BCVA of 20/200 in one eye at follow-up in persons who had a BCVA >20/200 in both eyes at baseline. Socio-demographic and clinical risk factors identified at the baseline interview and examination and associated with incident VI and loss of vision were determined using multivariable regression. Odds ratios (OR) were calculated for those variables that were independently associated with visual impairment and monocular blindness.

Main Outcome Measures—ORs for various risk factors for incident VI and monocular blindness

Results—Independent risk factors for incident VI were older age (70–79 years OR=4.8, 80 years OR=17.9), being unemployment (OR=3.5), and having diabetes mellitus (OR=2.2). Independent risk factors for monocular blindness were being retired (OR=3.4) or widowed (OR=3.7), having diabetes mellitus (OR=2.1) or any ocular disease (OR=5.6) at baseline. Persons

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with self-reported excellent/good vision were less likely to develop VI or monocular blindness (OR=0.4–0.5).

Conclusion—Our data highlight that older Latinos and Latinos with diabetes mellitus or self-reported eye diseases are at high risk of developing vision loss. Furthermore, being unemployed, widowed or retired confers an independent risk of monocular blindness. Interventions that prevent, treat, and focus on the modifiable factors may reduce the burden of vision loss in this fastest growing segment of the United States population.

Visual impairment is an important public health concern. In the United States (US), approximately 3.6 million people who are 40 years or older suffer from visual impairment.¹ Visually impaired individuals have decreased functional status^{2,3} and poorer quality of life,⁴ and the economic consequences of visual impairment are immense. A 2007 study estimated the total annual economic impact of adult vision problems in the US at \$51.4 billion.⁵ To better address this prevalent, incapacitating, and costly public health issue, it is essential to identify the risk factors that predispose individuals to developing visual impairment.

Latinos are the largest and fastest growing ethnic minority in the US.⁶ The 46.9 million US Latinos in 2008 made up 15.4% of the total population.⁷ If recent trends continue, the US Latino population is estimated to increase to 102.6 million in 2050, or 24.4% of the total population.⁸ Despite Latinos comprising an enormous portion of the US population, little is known about the unique characteristics of Latino ocular health; previous population-based incidence studies have focused only on Caucasians and those of African descent.^{9–15} The Los Angeles Latino Eye Study (LALES), which was conceived to fill this void, is the first study to examine the incidence of ocular disease in Latinos.

The LALES is a population-based prospective study designed to survey the incidence, causes, and risk factors of vision loss in Latinos 40 years and older living in La Puente, California, a largely Latino area of Los Angeles County with an age distribution similar to that of the US Latino population. A previously published report describes the high prevalence of visual impairment in Latinos.¹⁶ While cross-sectional studies can identify associations between risk factors and existing visual impairment, longitudinal incidence studies are required to determine the factors that may be associated with the development of future vision loss. Thus, this study allows the identification of those risk factors in the Latino population that are associated with a higher risk of developing vision loss. Individuals with these characteristics are likely to benefit the most from preventive, screening and treatment programs.

The objectives of the current report are to: (1) elucidate the socio-demographic and clinical risk factors that are associated with the development of vision loss; (2) explain the findings and identify strategies to lessen the burden of eye disease; (3) compare risk factors for incident visual impairment to those associated with prevalent visual impairment; and (4) compare the risk factors to prospective population-based studies in other racial/ethnic groups.

METHODS

Study Cohort

The study design has been previously described in detail.¹⁷ In summary, data collection for the cross-sectional baseline study took place from 2000 to 2003. Participants were identified by a door-to-door census of all residents within 6 census tracts in La Puente, Los Angeles County, California. Eligibility required being 40 years or older and self-identifying as Latino. Of 7789 eligible residents who were invited to participate, 6357 (82%) completed in-home questionnaires and clinical examination. All living eligible participants from the baseline study were invited to participate in the 4-year follow-up incidence study, which took place from 2004 to 2008¹⁸. Institutional Review Board approval was obtained from the Los Angeles County/University of Southern California Medical Center Institutional Review Board, and all procedures adhered to the Declaration of Helsinki.

Risk Factor Assessment

In-home interviews were conducted after informed consent was obtained. All data were collected via computer-assisted, in-person interviews in the preferred language. The interviews included questions regarding the following socio-demographic information: sex, age, country of birth (US or foreign), acculturation (Cuellar 9-item acculturation scale),¹⁹ working status (employed, retired, unemployed), years of education, marital status (married/living with a partner, separated/divorced, widowed, never married), annual income, and health/vision insurance status (coverage or no coverage). Clinical information included past medical history (13 self-reported conditions: diabetes mellitus, arthritis, stroke, hypertension, angina, myocardial infarction, congestive heart failure, asthma, skin cancer, other malignancies, back problems, hearing problems, and other major health issues), past self-reported ocular history (cataract, glaucoma, macular degeneration, diabetic retinopathy, or any ocular disease), and self-reported excellent/good health/vision (yes or no). The comprehensive examinations included visual acuity, visual field, anterior segment examination using a slit lamp, and dilated fundus examinations using direct and indirect ophthalmoscopy by a trained ophthalmologist. Those who did not complete examinations at the local eye examination center (LEEC) were examined at home by trained ophthalmologists and technicians.

Visual Acuity Testing

Visual acuity was determined with using transilluminated revised Early Treatment Diabetic Retinopathy Study (ETDRS) charts at 4 m (Precision Vision, La Salle, IL). Lea symbols were used for illiterate individuals. If participants read fewer than 55 letters in either eye at 4 m, they underwent auto-refraction using the Humphrey Automatic Refractor (model 599, Carl Zeiss Meditec, Dublin, CA) followed by subjective refraction. Using the best refraction, a best corrected visual acuity was measured for each eye (BCVA). If participants read fewer than 20 letters at 4 m, visual acuity was measured at 1 m. Visual acuities were converted into logarithm of the minimal angle of resolution (logMAR) scores and adjusted for exam distance. A logMAR score of 1.7 was assigned for counting fingers, hand motion, light perception, and no light perception.

Multiple layers of quality control measures were implemented, including independent confirmation of presenting visual acuities of 20/40 or worse by a second trained technician and validation of at least 5% of each interviewer's work and 10% of in-clinic questionnaires through telephone follow-ups. Data checks were also incorporated into the data management program, and data was reviewed by supervising technicians for completeness and accuracy.

Definitions of Vision Loss

Vision loss is categorized as visual impairment or blindness and monocular or bilateral (better seeing eye).

Incident Visual impairment in the better seeing eye: A baseline BCVA of 20/40 or better in the better-seeing eye and a BCVA worse than 20/40 but better than 20/200 (not including 20/40 or 20/200) in the better-seeing eye at follow-up. This definition is used by the Eye Diseases Prevalence Research Group²⁰ and in the incidence reports of the Barbados,^{14,21} Blue Mountains,¹⁰ and Reykjavik¹⁵ Eye Studies. ***Incident Monocular Visual impairment (first eye):*** A baseline BCVA of 20/40 or better in both eyes and a BCVA worse than 20/40 but better than 20/200 (not including 20/40 or 20/200) in one eye at follow-up. ***Worsening of Presenting Binocular visual acuity:*** Those persons with a baseline presenting binocular VA better than no light perception and a decrease in 15 letters read correctly binocularly with presenting refractive correction (not BCVA) at follow-up. ***Incident Monocular Blindness (first eye):*** Baseline BCVA better than 20/200 in both eyes and a BCVA of 20/200 or worse (including 20/200) in one eye at follow-up. Incident blindness in the better seeing eye (the legal definition of blindness) was not analyzed as the sample size was too small for robust analyses (n=12).

Statistical Analyses

The socio-demographic and clinical characteristics of participants with vs. without the above defined visual impairment end-points were analyzed using *t*-tests for comparison of means, and chi-square tests for comparison of proportions. The risk factors for incident visual impairment and blindness and worsening of binocular vision were identified by univariate logistic regression. Those univariate risk factors that were independently associated with visual impairment, blindness and worsening of binocular vision (using a $P = 0.20$ criterion in the univariate analyses for entry into the model) were identified by multiple logistic regression analyses with forward stepwise selection. The final multivariable predictive model consisted of factors that were significant at an alpha level less than 0.05 after adjustment of covariates. All analyses were performed using SAS version 9.1 (SAS Institute, Cary, North Carolina).

RESULTS

Study Cohort

The baseline demographic and socioeconomic characteristics of the participants were determined to be representative of the overall Latino population in Los Angeles County.¹⁷ Of note, 95% were of Mexican origin or descent. Of the 6100 living participants from the baseline study, 4658 (76%) participated in the 4-year incidence study. Participants with

visual impairment at the baseline examination were excluded from the current analysis. Characteristics of the follow-up cohort included 60% female, mean age 54.7 years (standard deviation of 10.5 years), 76% born outside of the US, 50% unemployed or retired, and 41% with two or more co-morbidities.¹⁸ Non-participants were more likely to be male, younger, have no insurance, have fewer co-morbidities and were less likely to have histories of hypertension, diabetes, and ocular conditions (all $P < 0.05$).¹⁸

Incident Visual impairment

Table 1 compares the socio-demographic and clinical risk factors of participants with incident visual impairment (BCVA worse than 20/40 in better-seeing eye) to those with no visual impairment. Fifty-five participants, or 1.2% (95% confidence interval [CI]: 0.9–1.5%), developed incident visual impairment.¹⁸ The independent risk factors of incident visual impairment (Table 2) were older age, being unemployed (Odds Ratio [OR] = 3.5 [1.4–8.9, $P = 0.03$]), and having diabetes mellitus (OR = 2.2 [1.3–3.9, $P = 0.006$]). Participants who reported excellent/good vision at baseline were less likely to develop visual impairment compared to those that did not (OR = 0.5 [0.3–10.0, $P = 0.04$]).

One hundred and twenty six persons developed monocular visual impairment with a 4 year incidence rate of 2.9% (95% CI: 2.4–3.4%) in the first eye.¹⁸ The independent risk factors for incident visual impairment in the first eye after adjusting for covariates in the multivariable regression model (Table 3) were older age, unemployment (OR = 2.6 [1.5–4.6, $P = 0.001$]), diabetes mellitus (OR = 2.0 [1.3–2.9, $P < 0.001$]), and history of ocular disease (OR = 2.2 [1.4–3.3, $P < 0.001$]). Self-reported excellent/good vision was protective (OR = 0.6 [0.4–0.9, $P = 0.01$]). The only independent risk factor for visual impairment in the second eye was older age.

Incident Blindness

Fifty four persons developed monocular blindness with a 4 year incidence rate of 1.2% (95% CI: 0.9–1.5) in the first eye, 7.6% (95% CI: 2.2–13.0) in the second eye, and 1.3% (95% CI: 1.0–1.6) in either eye.¹⁸ The independent risk factors for the 4 year incidence of monocular blindness in the first eye ($n=54$) after adjusting for covariates were: being retired (OR=3.4 [1.4–8.2], $P=0.02$), being widowed (OR=3.7[2.0–6.9], $P < 0.001$), having diabetes mellitus (OR=2.1[1.9–3.8] $P=0.01$), and having a history of ocular disease (OR=5.6[3.0–10.2], $P < 0.0001$). Persons with a self-reported history of excellent/good vision at baseline were less likely to develop monocular blindness (OR = 0.4 [0.2–0.8], $P = 0.01$). The sample size for the cases with incident bilateral blindness ($n= 12$) and monocular blindness in the second eye ($n= 7$) were too small to allow robust risk factor analysis.

Worsening of Presenting Binocular Visual Acuity

Worsening by 15 letters (doubling of the visual angle) in presenting binocular visual acuity was noted in 145 persons with a 4 year incidence rate of 3.1% (95% CI: 2.6–3.6%). The independent risk factors for worsening by 15 letters based on multivariate regression (Table 4) were older age, having diabetes mellitus (OR = 2.6 [1.8–3.9, $P < 0.001$]), and history of ocular disease (OR = 1.6 [1.0–2.5, $P < 0.04$]). The same independent risk factors were significant when the criterion for worsening vision was changed to 10 letters of worsening.

DISCUSSION

Latinos constitute the largest and fastest growing ethnic minority in the United States. Understanding the unique risk factors associated with eye disease in Latinos is therefore essential to improving health outcomes. However, there is a paucity of population-based incidence data on visual impairment. The LALES was designed to fill this void, and it is currently the only population-based Latino eye study that has collected longitudinal incidence data. Risk factor assessments by prospective incidence studies are valuable as these data identify risk factors that may predict future visual outcomes.

Previous LALES studies have shown that Latinos may have high prevalence and incidence of visual impairment.^{16,18} In the current study we have identified older age, being unemployed, having diabetes mellitus, and a history of ocular disease to be independently associated with incident visual impairment.

Socio-demographic Risk Factors

Older age was an independent risk factor for incident visual impairment, monocular visual impairment (first and second eyes), and worsening vision (all $P < 0.05$). Other population-based studies (Table 5), including the Beaver Dam, Blue Mountains, and Barbados Eye Studies, have also consistently identified older age as a risk factor for incident visual impairment.^{9–21} These findings are expected because older individuals are either exposed to environments that make them more susceptible to eye disease or aging of ocular and other tissues may reduce the ability to regenerate or reverse tissue breakdown and thus predispose the visual system to develop visually impairing conditions such as age-related macular degeneration, cataract, primary open-angle glaucoma, dry eye and diabetic retinopathy.

Cross-sectional prevalence studies have consistently demonstrated that lower socioeconomic status particularly unemployment is associated with visual impairment.^{22–24} However, cross-sectional studies may not be able to illuminate the temporal relationship between visual impairment and unemployment.^{23,24} Furthermore, the impact of socio-demographic factors on incident visual impairment has been largely unexplored. The prospective nature of incidence studies allows us to further explore this relationship. Our prospective data suggest that unemployment is an important predictor for future visual loss. At the same time, we cannot discount the fact that persons who are visually impaired have lower employment rates.²⁵ A combination of these two reasons is probably the most likely explanation for our observation. Furthermore, this combination results in a vicious cycle of unemployment leading to visual impairment which may lead to further unemployment. One approach to addressing this would be to target screening and intervention programs at unemployed persons who are visually impaired. Of note, lack of health and vision insurance were not identified as independent risk factors. One explanation for this observation could be that insurance status may be collinear with employment particularly in those who are younger than the Medicare and Medicaid eligibility age. Another explanation may be that persons who are unemployed are more likely to be depressed and have higher levels of psychosocial stress which can lead to a reduction in a person's ability to access the health care system and take care of their health related issues. Similarly persons who are retired may be less likely to be physically and socially active as they no longer have work related activities that keep

them active. Additionally, persons who are widowed may have a smaller social network than those who are married. This lack of active living behaviors and smaller social networks reduces a person's ability to access and navigate the health care system thereby leading to poorer vision outcomes.

Clinical Risk Factors

Diabetes mellitus was an independent risk factor for incident visual impairment, worsening vision, monocular visual impairment in the first eye and monocular blindness. These findings are particularly concerning because Latinos have high prevalence and incidence rates of diabetes mellitus. The most recent National Health and Nutrition Examination Survey indicated that diagnosed diabetes is 1.7 times more prevalent in Mexican Americans than in non-Hispanic whites.²⁶ If current trends continue, Latino children born in 2000 are projected to have a one in two lifetime risk of developing diabetes mellitus.²⁷ Population-based studies have demonstrated that persons with diabetes are predisposed to developing multiple ophthalmic conditions, including diabetic retinopathy,^{28,29} macular edema, cataract,^{30–32} open angle glaucoma,^{33,34} dry eye syndrome,³⁵ and central retinal vein occlusion.³⁶ Together, these data suggest that preventing, diagnosing, and treating diabetes and its related complications is likely to reduce the burden of vision loss in Latinos.

History of any ocular disease was an independent risk factor for worsened vision, monocular visual impairment and monocular blindness in the first eye. These findings suggest that persons with a history of eye disease (of any cause) are predisposed to developing vision loss either due to the presence of a progressive ocular or systemic condition, or due to increased environmental exposure to factors that may contribute to progressive vision loss. Conversely, persons with self-reported excellent/good vision at baseline were less likely to develop incident visual impairment, monocular visual impairment and monocular blindness in the first eye. These data indicate that the patient's subjective perception of their vision could serve as a predictor of future visual impairment. This has several important implications. First, self-reported satisfaction with current vision should be routinely incorporated into health screening questionnaires and in the primary care provider's review of systems. Secondly, if a person complains of poor vision, healthcare and eye care providers should consider it as an important predictor of future eye disease and carefully examine the person for signs of early eye disease. Moreover, these persons may also benefit from routine regular eye examinations to detect and manage early eye disease.

In LALES, the 4 most frequent causes of incident VI (excluding refractive error) were cataract, diabetic retinopathy, AMD, and glaucoma. Many of these causes of VI in Latinos are treatable or preventable. This observation suggests that preventive and management interventions are warranted in Latinos.

Comparison of Risk factors for Incident and Prevalent Visual Impairment

The independent risk factors for any visual impairment in our baseline prevalence study were older age, unemployment, being separated/divorced or widowed, less education, diabetes, and history of ocular disease.¹⁶ Of these baseline factors, those that also predicted incident visual impairment after 4 years were older age, unemployment, diabetes, and

history of ocular disease. There was a higher prevalence of visual impairment in females in the baseline study (age-adjusted rates: 4% in females, 2.6% in males), but sex-related differences were not noted in the current incident study. However, despite some similarities, care should be exercised when making direct comparisons, because the definitions of the primary endpoints of the two studies are different. The baseline study assessed risk for any existing visual impairment, defined as 20/40 or worse in the better-seeing eye, including 20/40 and including blindness in all persons, whereas the incidence study identifies risk factors for newly developed vision loss over the previous four years. The definitions for incidence vision loss were modified in the current study to reflect the methodologies employed by studies such as the Eye Diseases Prevalence Research Group,²⁰ the Barbados Eye Study,²¹ and the LALES incidence study report.¹⁸

Comparison of Risk factors for Incident Visual Impairment in other Population-Based Studies

All major prospective cohort studies have identified older age as a risk factor of incident visual impairment. Table 5 presents a summary of results from selected studies with follow-up periods of 3 to 7 years and sample sizes larger than 500. Institutionalization is an interesting risk factor that was implicated by the Beaver Dam Eye Study.⁹ This variable was not assessed in the LALES because Latino families are less likely to utilize such facilities when caring for older adults.

There have been few studies that have performed a detailed assessment of risk factors for incident vision loss. Similar to our findings, Reykjavik,¹⁵ Melbourne,¹³ and the Priverno¹¹ Eye Studies did not find any sex-related differences. In Beaver Dam and Barbados men were more likely to develop incident visual impairment whereas in the Blue Mountains Eye Study,¹⁰ female gender was associated only with monocular visual impairment. The Priverno Eye Study¹¹ also examined socioeconomic status, smoking and alcohol consumption, but none were found to be associated with vision loss. In addition to these variables, the Beaver dam Eye Study identified baseline visual acuity, older birth cohorts and institutionalization to be significant risk factors.^{37,38} While it may be appropriate to compare the general direction of these risk associations, it is not appropriate to make direct comparisons between these studies, due to differences in age selection criteria, race/ethnicity, follow-up time, and definitions of risk factors and end-points.

Strengths and Limitations

Our study has several strengths. LALES is the largest population-based incidence study of visual impairment in any racial/ethnic group. Incidence studies such as our study are less likely to be impacted by temporality issues such as prevalent case bias and thus provide a more accurate assessment of the relationship between risk factors and vision outcomes. Lastly, the use of standardized methodologies and stringent quality control measures provide greater assurance regarding the accuracy and reliability of our data.

Our study also has important limitations that need to be considered when evaluating our data. While the overall participation rate is relatively high, participants and nonparticipants differed in several factors. However, given that these differences were small they are unlikely

to change the risk factors that we identified in our regression models. Secondly, the number of cases with incident legal blindness during 4 years was too small for a robust risk factor analysis. A longer follow-up study would provide additional cases for conducting such an analysis. Thirdly, the participants in LALES were largely Latinos of Mexican ancestry. Thus, the results cannot be generalized to other Latino populations. It should be noted, however, that Latinos of Mexican origin constitute approximately two thirds (66%) of Latinos living in the US.⁷

In summary, LALES is the largest population-based study of incident visual impairment that reports on the risk factors for vision loss in Latinos. These include older age, unemployment, diabetes, and history of ocular disease. Interventions that prevent, treat, and focus on these as well as the major underlying diseases may reduce the burden of ocular disease in this fastest growing segment of the US population.

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Distribution of Socio-demographic and Clinical Risk Factors stratified by presence of Incident Visual Impairment* in the better seeing eye in participants in the Los Angeles Latino Eye Study

Table 1

Risk Factor	VI, n (%) (n = 55)	No VI, n (%) n = 4507	P [†]
Socio-demographic Factors			
Sex			0.57
Male	24 (43.6)	1796 (39.9)	
Female	31 (56.4)	2710 (60.1)	
Age Group			<0.001
40–49 years	8 (14.6)	1743 (38.7)	
50–59 years	6 (10.9)	1438 (31.9)	
60–69 years	15 (27.3)	898 (19.9)	
70–79 years	16 (29.1)	367 (8.1)	
80 + years	10 (18.8)	61 (1.4)	
Country of birth (US)	14 (25.5)	1053 (23.4)	0.72
Acculturation score [mean (SD)]	1.7 (0.9)	1.8 (0.9)	0.32
Working status			<0.001
Employed	6 (10.9)	2299 (51.2)	
Retired	25 (45.5)	627 (14.0)	
Unemployed	24 (43.6)	1567 (34.9)	
Years education [mean (SD)]	6.4 (4.2)	8.3 (5.3)	0.001
Marital status			<0.001
Married/living with partner	31 (56.4)	3348 (74.4)	
Separated/divorced	7 (12.7)	527 (11.7)	
Widowed	16 (29.1)	348 (7.7)	
Never married	1 (1.8)	275 (6.1)	
Income level < \$20,000	34 (72.3)	1941 (48.4)	0.001
Have health insurance	42 (76.4)	3010 (66.9)	0.14
Have vision insurance	32 (58.2)	2372 (53.2)	0.47
Clinical Risk Factors			
No. of co-morbidities [mean (SD)]	2.5 (1.7)	1.5 (1.5)	<0.001

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Risk Factor	VI, n (%) (n = 55)	No VI, n (%) n = 4507	P [‡]
History of hypertension	25 (45.5)	1325 (29.5)	0.01
History of diabetes	21 (38.2)	814 (18.1)	<0.001
History of any ocular disease	21 (38.2)	548 (12.2)	<0.001
Self-reported excellent/good health	48 (87.3)	3643 (80.8)	0.23

SD = standard deviation; US: United States of America;

* VI =Incident visual impairment - best corrected visual acuity 20/40 at baseline in the better seeing eye and < 20/40 but > 20/200 at follow-up in the better-seeing eye

[‡] Comparing VI to no VI

Table 2Independent Risk Factors[†] for Incident Visual Impairment in the better seeing eye in participants in the Los Angeles Latino Eye Study^{*}

Risk Factor	OR (95% CI)	P
Age (years)		<0.001
40–49 (ref [‡])	1	
50–59	0.7 (0.2–2.1)	0.12
60–69	2.2 (0.9–5.6)	0.46
70–79	4.8 (1.7–3.4)	0.04
80	17.9 (5.9–54.0)	<0.001
Employment Status		0.03
Employed (ref [‡])	1	
Retired	3.4 (1.1–10.0)	0.04
Unemployed	3.5 (1.4–8.9)	0.03
Presence of Diabetes mellitus		
No (ref [‡])	1	
Yes	2.2 (1.3–3.9)	0.006
Excellent/good self-reported vision		
No (ref [‡])	1	
Yes	0.5 (0.3–10.0)	0.04

[†]Based on a stepwise logistic regression model; OR = odds ratio; CI = confidence interval^{*} Incident visual impairment - best corrected visual acuity 20/40 at baseline and <20/40 but >20/200 at follow-up in the better-seeing eye; ref[‡] : referent group

Independent Risk Factors for Incident Monocular Visual Impairment and Monocular Blindness in the first eye in participants in the Los Angeles Latino Eye Study

Table 3

Risk Factor	Monocular Visual Impairment OR (95% CI)	P	Monocular Blindness OR (95% CI)	P
Age (years)				
40–49 (ref ^P)	1		NS	
50–59	1.5 (0.7–3.1)	0.06		
60–69	5.3 (2.7–10.4)	0.001		
70–79	11.2 (5.2–24.3)	<0.001		
80	10.7 (3.6–31.6)	0.006		
Working status				
Employed (ref ^P)	1		1	
Unemployed	2.6 (1.5–4.6)	0.001	2.3 (1.0–5.3)	0.05
Retired	1.9 (0.98–3.6)	0.06	3.4 (1.4–8.2)	0.02
Presence of Diabetes mellitus				
No (ref ^P)	1		1	
Yes	2.0 (1.3–2.9)	<0.001	2.1 (1.9–3.8)	0.01
History of any ocular disease				
No (ref ^P)	1		1	
Yes	2.2 (1.4–3.3)	<0.001	5.6 (3.0–10.2)	<0.001
Self-reported excellent/good vision				
No (ref ^P)	1			
Yes	0.6 (0.4–0.9)	0.01	0.4 (0.2–0.8)	0.01
Marital status				
Married/living with partner (ref ^P)	NS		1	
Separated/divorced			1.1 (0.4–2.8)	0.52
Widowed			3.7 (2.0–6.9)	<0.001
Never married			0.9 (0.2–3.8)	0.55

OR = odds ratio; CI = confidence interval; ns Non significant;

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* Incident monocular visual impairment - best corrected visual acuity 20/40 at baseline in both eyes and < 20/40 but > 20/200 at follow-up in one eye. ref P : referent group
Incident monocular visual impairment - best corrected visual acuity 20/40 at baseline in both eyes but < 20/200 at follow-up in one eye. ref P : referent group

Independent Risk Factors for Worsening () 15 letter or doubling of the visual angle) of Presenting Binocular visual acuity* in participants in the Los Angeles Latino Eye Study

Table 4

Worsening of Presenting Binocular Visual Acuity*		
Risk factor	OR (95% CI)*	P
Age (years)		
40–49 (ref [†])	1	<0.0001
50–59	2.2 (1.1–4.3)	0.002
60–69	3.6 (1.9–7.0)	0.003
70–79	7.0 (3.5–14.2)	0.003
80	17.8(7.5–41.9)	<0.001
Presence of Diabetes mellitus		
No (ref [†])	1	
Yes	2.6 (1.8–3.9)	<0.001
History of any ocular disease		
No (ref [†])	1	
Yes	1.6 (1.1–2.5)	0.036

* OR = odds ratio; CI = confidence interval, ref[†] : referent group

Table 5

Risk Factors for Incident Visual Impairment in Population-Based Studies

Incidence Study	Study Location	Race/Ethnicity	n	Baseline Data Collection	Follow-Up (yrs)	Mean Age (yrs)	Independent Risk Factors for Incident Visual Impairment [†] (P<0.05)
Los Angeles Latino Eye Study	United States	Latino	4520	1998–2003	4	55	Older age, unemployment, retirement, diabetes, and history of ocular disease.
Barbados Eye Study ¹⁴	Barbados	Afro-Caribbean	3142	1987–1992	4	56*	Older age
Beaver Dam Eye Study ⁹	United States	White	3684	1988–1990	5	60	Older age, institutionalization
Blue Mountain Eye Study ¹⁰	Australia	White	2335	1992–1994	5	65	Older age, female sex (only for monocular impairment), right eye (only for blindness)
Melbourne Visual Impairment Project ¹³	Australia	White	2594	1991–1998	5	59	Older age
Priverno Eye Study ¹¹	Italy	White	619	1987	7	57	Older age
Reykjavik Eye Study ¹⁵	Iceland	White	846	1996	5	65	Older age
Southwest Uganda ¹²	Uganda	Black	2124	1994–1995	3	36	Older age

* Median age.

[†] Various definitions. n sample size.⁹ Klein R, Klein BE, Lee KE. Changes in visual acuity in a population. The Beaver Dam Eye Study. *Ophthalmology* 1996;103:1169–78.¹⁰ Foran S, Mitchell P, Wang JJ. Five-year change in visual acuity and incidence of visual impairment: the Blue Mountains Eye Study. *Ophthalmology* 2003;110:41–50.¹¹ Cedrone C, Culasso F, Cesareo M, et al. Incidence of blindness and low vision in a sample population: the Priverno Eye Study, Italy. *Ophthalmology* 2003;110:584–88.¹² Mbulaiteye SM, Reeves BC, Mulwanyi F, et al. Incidence of visual loss in rural southwest Uganda. *Br J Ophthalmol* 2003;87(7):829–33.¹³ Dimitrov PN, Mukesh BN, McCarty CA, Taylor HR. Five-year incidence of bilateral cause-specific visual impairment in the Melbourne Visual Impairment Project. *Invest Ophthalmol Vis Sci* 2003;44:5075–81.¹⁴ Leske MC, Wu SY, Hyman L, et al. Four-year incidence of visual impairment: Barbados Incidence Study of Ocular diseases. *Ophthalmology* 2004;111:118–124.¹⁵ Gunnlaugsdottir E, Arnarsson A, Jonasson F. Five-year incidence of visual impairment and blindness in older Icelanders: the Reykjavik Eye Study. *Acta Ophthalmol* 2010;88:358–366.